A BRIEF REVIEW OF SELECTED STUDIES OF APPLE PRICES

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AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

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INTRODUCTION

Apple growers are currently going through a period when apple prices are low and costs are high. It is small comfort to them to remember that there have been other periods when the reverse was true --- or that in still other periods they have had prices that were even lower than now relative to their costs. Consequently, growers are seeking the means of improving their situation by means other than greater efficiency in growing, better quality, etc. They are joining into groups to change their methods of marketing, they are seeking to increase their bargaining power and are trying in other ways to solve their problems. In all of these, however, apple as well as other producers, are faced with inadequacies of information and with economic laws that can limit their actions as effectively or even more effectively than can the presence or absence of statuatory laws.

Several studies of the effects of economic forces on apple prices and on grower income have been made over the past 20 years. This report very briefly summarizes some of this research. It is not intended to be all inclusive or to exhaust the information in the sources mentioned. It is hoped that this summary will help in directing the discussion by grower's and marketer's about their mutual problems in such a way that the discussions will be most productive.

RESEARCH FINDINGS

The following research reports and the discussion and chart materials are related to each other only by the fact that they deal with apples and apple prices. In summarizing them the author has attempted to interpret the findings rather than to present them verbatum.

Supply-Price Relationships

Farmers are concerned with apple prices in at least three ways:

1. Decision to plant or not - long term price outlook by variety and type.
2. Decision to sell or store - seasonal price outlook.
3. How or where - what market city-process or fresh

1. Decision to Plant - they would like to know the causes of price variation from one year to next and to know how these causes will vary over 10-35 year period. Several studies of some of the causes have been made. A study made in 1939 by Gordon Ockey covering the years 1922-1938 showed that 96 per cent of the crop to crop price variation was caused by changes in apple production, non-agricultural income and orange production.[1]

In a study using slightly different techniques made by Karl Fox in 1951, for the crop years 1922-41, 96 per cent of the year to year variation in the farm price of apples was explained by variations in the size of the apple crop and disposable consumer income.[2]

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[1] Fruit Situation, August 1939, Agricultural Marketing Service, U.S.D.A.

[2] "Factors Affecting Farm Income, Farm Prices and Food Consumption" Agricultural Economics Research 3:62-82, July 1951, U.S.D.A.

He did not consider orange production. A 1 per cent change in apple production was found to be associated with 0.8 per cent change in apple price in the opposite direction. A 1 per cent change in disposal income was associated with a change of 1 per cent in apple prices in the same direction.

French, using the years 1930-1953 except for the war years, explained 95 per cent of the year to year farm price variations in apples by using the total per capita supply of apples, consumer income and combined per capita consumption of oranges, pears and bananas.[3] He found that a 1 per cent change in the production of apples is associated with an .84 per cent change in farm price in the opposite direction. French also concluded that the nature of the demand for apples was not appreciably affected by the rapid increase in incomes occuring over the period studied, although some shifts had apparently occurred.

These and other studies indicate that the size of the apple crop and the income of consumers are the two major causes of year to year changes in apple prices. These two with or without the effect of competing fruits apparently account for a major part of the price variations. Two of these studies, however, were made entirely on prices during the period between World Wars I and II. While these relationships probably still hold there are some who doubt that they do. Of course, the effects of changes in the value of the dollar are removed insofar as possible in these analyses. The longer term outlook will be discussed later.

2. To sell or to store and when to sell from storage. The major problem of when to sell has to be decided each year. Of course,

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[3]Ben C. French - The Long Term Price and Production Outlook for the U.S. and Michigan, Mich. State Univ. Agr. Exp. Sta. Tech. Bul. 255, April, 1955

the presence or absence of grower owned storage facilities may be a major factor in determining the policy followed. Two studies have been made of the factors affecting month to month apple price changes. One, completed in 1954 correlated the production estimate in August with prices in September, October and November and the October production estimate with prices in November, December and January. Over 80 per cent of the variation in prices for a particular month from the same month the previous year was accounted for by the change in the estimated size of crop and by changes in disposable consumer income.[4]

As far as the amount stored was concerned, the two factors, size of apple crop and the price of apples October 15 explained 87 per cent of the differences in the volume of apples in storage from one December to the next. A 1 per cent change in the size of crop was associated with a 1.24 per cent change in the same direction in December storage holdings. Similarly, a 1 per cent change in October 15 price was associated with a 0.4 per cent change in the same direction in amount stored -- after the effect of crop size was taken into account.

In another study published in 1952, L. L. Boger, at Michigan, attempted to determine the most probable price of apples each month of the harvest-storage season by using information available at harvest.[5]

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[4] Ben Pubols - Agricultural Economics Research, AMS, U.S.D.A. Volume VI, No. 3, July, 1954.

[5] L. L. Boger, When Should Apples Be Sold, Special Bulletin 381 Mich. Agr. Exp. Sta., September, 1952.

He predicted the direction seasonal of the price movement correctly in 24 of the 26 years beginning with 1923. Again, the two factors, size of crop and disposable consumer income were the major ones. He found that the actual level of apple prices in the fall had little relationship to whether it paid to store or not.

3. How or where - What city - Process or fresh - There are no ready answers to these questions and no significant research has been done or perhaps can be done on them. Their answer must be determined year by year and week by week by each grower. Progress has been made in organizing group sales agencies, cooperative and other, with full time salesmen who spend more time at determining the best place to sell than most individual growers are able to do. Nevertheless, this area remains one where judgment and good market contacts play a very important part.

The importance of the processing market continues to grow. The per capita market of processed apples is more than twice as great as it was in the early 1930's while the per capita consumption of fresh apples is about one-half that in the early 1930's. However, the fresh market continues to be the large end of the deal, accounting for over 70 per cent of total consumption (Table I).

TABLE 1. FRESH AND PROCESSED PER CAPITA APPLE CONSUMPTION,

Farm Weight Equivalent, U.S., 1930-57

Year	Fresh	Canned	Canned Juice	Frozen	Dried	Total
1930	42.1	1.7	---	---	1.5	45.3
1931	51.7	1.2	---	---	.8	53.7
1932	39.2	1.2	---	---	.7	41.1
1933	40.0	1.4	---	---	.7	42.1
1934	25.3	1.5	---	---	.9	27.7
1935	32.9	1.5	---	---	1.0	35.4
1936	27.6	1.6	---	---	1.2	30.4
1937	33.6	2.0	---	*	1.3	36.9
1938	28.2	1.8	---	0.1	1.2	31.3
1939	30.7	1.9	0.1	*	.9	33.6
1940	29.7	2.2	.2	*	1.7	33.8
1941	31.7	2.5	.3	.1	.8	35.4
1942	28.1	2.6	.6	.1	.3	31.7
1943	24.9	2.3	.7	.2	.1	28.2
1944	25.5	1.4	1.0	.5	.4	28.8
1945	22.9	1.7	.4	.8	.8	26.6
1946	23.0	1.9	.5	1.0	1.5	27.9
1947	25.4	2.4	.4	.6	1.3	30.1
1948	26.3	2.8	.3	.6	1.3	31.3
1949	25.0	2.9	.7	.5	1.1	30.2
1950	23.2	3.5	.9	.5	1.2	29.3
1951	25.9	3.4	.8	.4	1.0	31.5
1952	21.9	4.0	.8	.5	1.0	28.2
1953	21.0	3.5	.8	.4	.9	26.6
1954	20.1	3.6	1.1	.5	.9	26.2
1955	19.8	4.1	.8	.7	.9	26.5
1956	19.3	4.4	1.0	.8	.7	26.2
1957	19.3	4.4	1.0	.7	.2	25.6

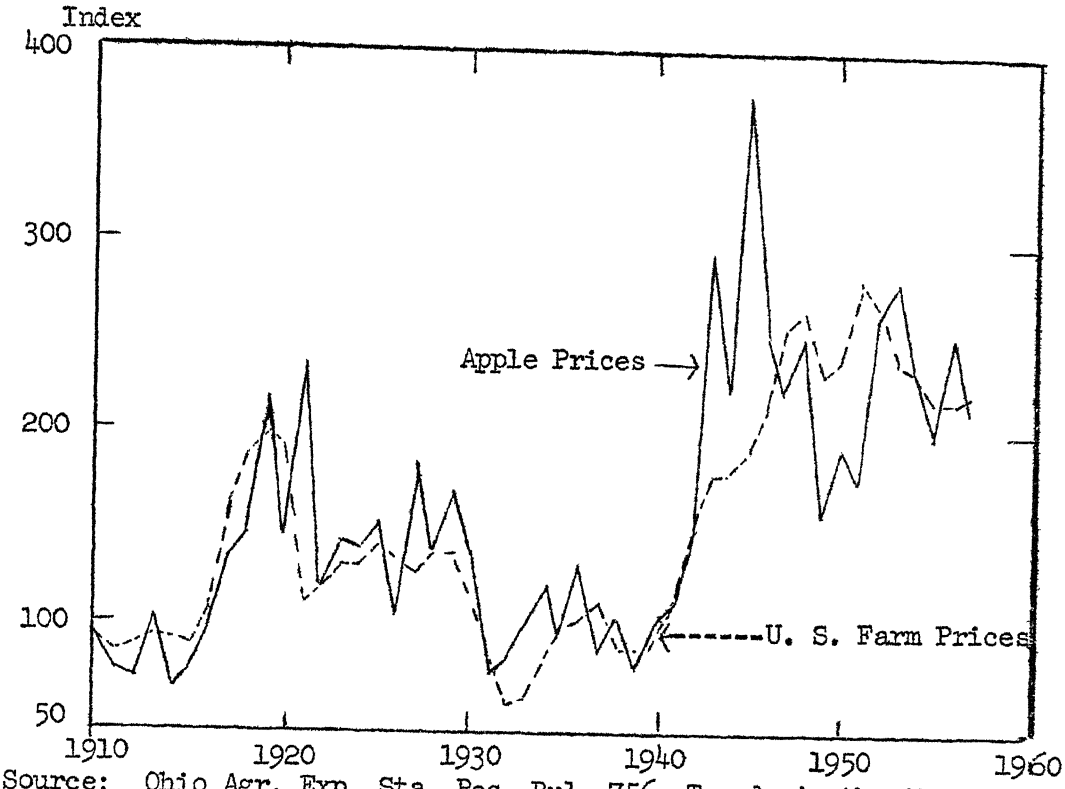
*Less than 0.05 pounds.

Source: Fruit Situation - AMS, U.S.D.A., March 1958

MISCELLANEOUS STUDIES ON APPLE PRICES AND PRODUCTION

These include studies of tree numbers, plantings, price trends and predictions of future production and prices for apples. The data are largely presented through charts taken from existing publications. They may furnish clues as to what can and cannot be done but rarely do they suggest solutions.

FIGURE 1. COMPARISON OF APPLE PRICES IN EASTERN AND CENTRAL STATES WITH PRICES OF ALL U.S. FARM PRODUCTS 1910-1957



Source: Ohio Agr. Exp. Sta. Res. Bul. 756, Trends in the Ohio Apple Industry 1889 - 1953 by M.E. Cravens, Jr. and R.L. Bere, February, 1955.

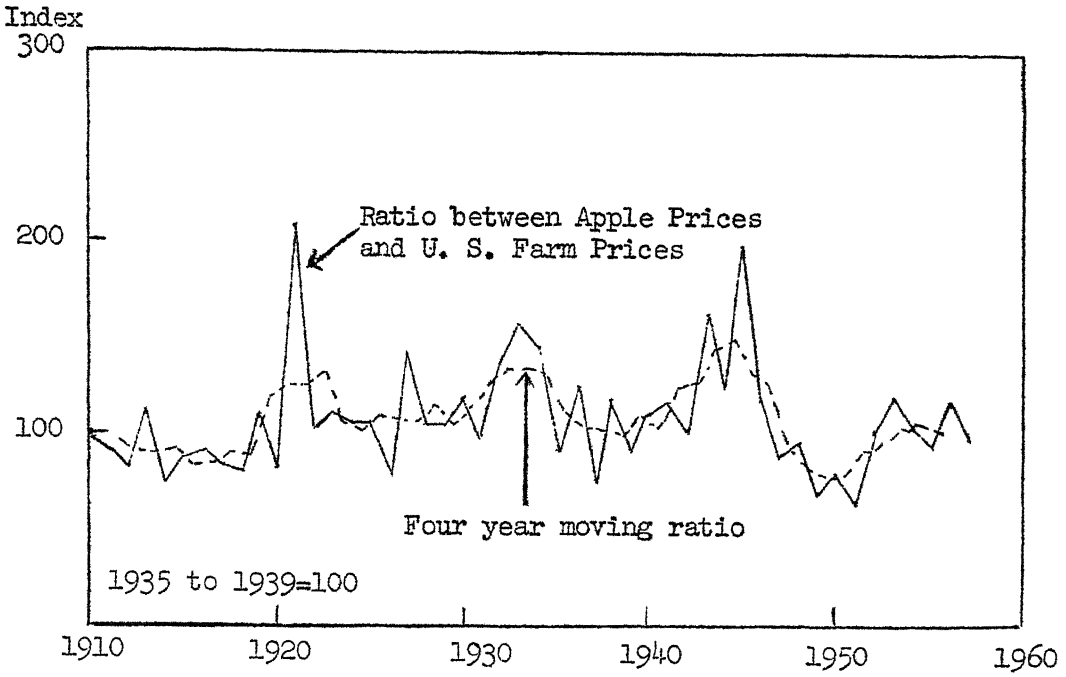
If you had been producing apples in 1910-15, you would have received the average price of around 70 cents a bushel. If you had continued to produce them until now, you would have received yearly average prices for apples ranging from about 64 cents to more than $3.00 a bushel. Two causes have been responsible for most of this variation.

1. Variations in the production of apples.
2. Variations in the general level of all prices --- primarily variations in the value of our money.

The first of these causes was very important in changing variations in apple prices from one year to the next. (Note the frequent alternate year high and low prices in Figure 1). The second was important in determining the general level around which the price of apples fluctuated. Either of these causes of variation in prices may affect the profits in the apple enterprise. However, it is not always true that apple growers make a higher profit with higher than lower priced apples, whether this be due to inflation (increase in the general level of all prices) or to shorter crops. Apple prices today are more than twice as high as they were in the early 1930's, but the profits of the apple industry are not twice as great. Costs are much higher than then.

There is little that the individual producer or the entire apple industry can do to influence the general level of prices or to eliminate the effects of such a monetary change on the apple industry (although Senator Byrd for one has attempted to prevent inflation caused by an unbalanced budget and to promote other measures aimed at a sounder currency). The best that members of the industry can do is to recognize the fact that in the long run, inflation does not necessarily mean a higher profit. Since inflation does not have this advantage and since it does have serious disadvantages, apple growers might well support those opposing inflationary legislation.

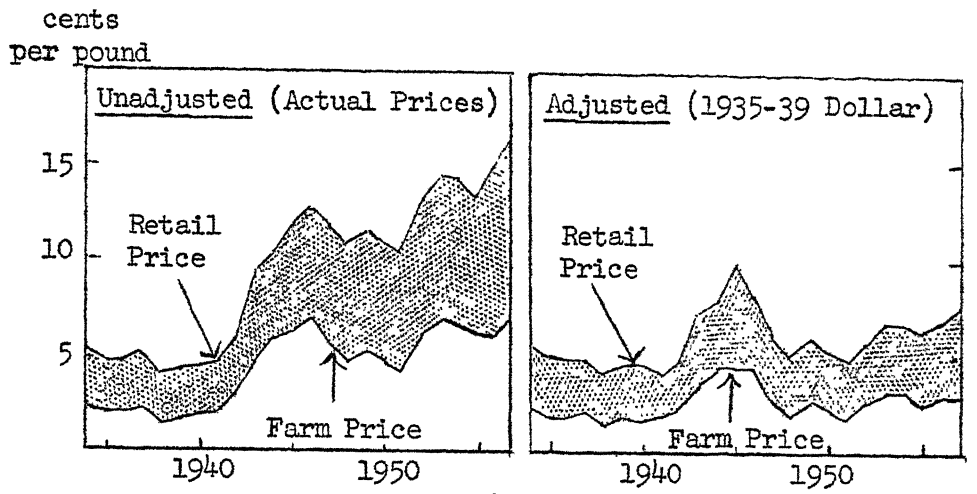
FIGURE 2. RATIO OF U.S. APPLE PRICES TO ALL U.S. FARM PRICES 1910-1957



Source: U.S.D.A. Statistics

In addition to the year to year price variations shown on the previous page, apple prices tend to have longer periods of movement. Apples tend to be relatively high priced for several years then relatively low priced when compared with the prices of other commodities. These high priced periods are about 10-12 years from peak to peak. (Note the dotted line in Figure 2.) This relationship was observed by Woodin, in 1941, and reported in Bulletin 771, Cornell Agr. Exp. Sta. It is likely that these years of alternately low and high priced apples are caused by periods of over and under planting with about 8-10 years being required for the trees to affect production. The relationship between apple prices and sales of apple trees by nurseries as shown in Figure 6 is a further indication of the fact that apple prices determine rates of planting and consequently affect later production. The most recent "peak" in apple prices was reached about 1955 and the years since have had declining prices with the next peak expected no sooner than 1965. The analyses by French and Brush would indicate that this rise will occur later than in 1965.

FIGURE 3. FARM AND RETAIL PRICES AND MARKETING MARGINS FOR APPLES U.S., 1934-57



Source: Ohio Agr. Exp. Sta. Res. Bul. 756, Trends in the Ohio Apple Industry 1889-1953 by M.E. Cravens, Jr. and R.L. Bere, February, 1955.

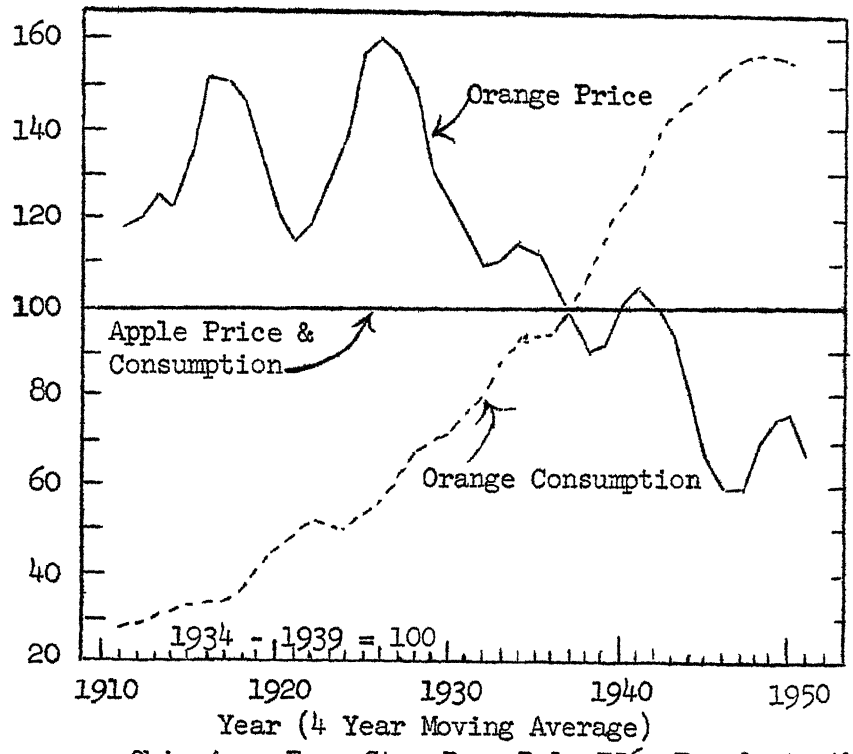
Marketing margins are a much discussed subject today. In this discussion we frequently deal with dollars or percentages to growers or dealers without consideration of the value of the dollar and its effect on the various parties. The chart to the left shows farm and retail prices and marketing margins in actual dollars. The chart to the right shows the farm and retail price in 1935-1939 dollars.*

Both the farm price and the marketing margin have increased since 1939. Except for the wartime increase, the greatest change in the marketing margin appears to have been in the increase since 1951.

*Actual Prices in 1935 - 1939 Dollars:

Year	Farm Price	Retail Price	Marketing Margin	Year	Farm Price	Retail Price	Marketing Margin
	(¢ per lb.)				(¢ per lb.)		
1934	2.4	5.9	3.5	1946	4.7	8.5	3.8
1935	2.1	5.2	3.1	1947	3.1	6.4	3.3
1936	2.1	5.0	2.9	1948	2.3	5.4	3.1
1937	2.2	5.0	2.8	1949	2.8	6.1	3.3
1938	1.7	4.5	2.8	1950	2.4	5.7	3.3
1939	2.0	4.8	2.8	1951	2.0	4.9	2.9
1940	1.9	4.8	2.9	1952	2.9	6.2	3.3
1941	2.0	4.4	2.4	1953	3.4	7.0	3.6
1942	2.5	5.1	2.6	1954	3.3	6.9	3.6
1943	3.8	7.5	3.7	1955	2.9	6.6	3.7
1944	4.6	8.2	3.6	1956	2.9	7.0	4.1
1945	4.7	9.1	4.4	1957	3.1	7.6	4.5

FIGURE 4. A COMPARISON OF TRENDS OF THE CONSUMPTION AND PRICES OF ORANGES AND APPLES, 1910-1956



Source: Ohio Agr. Exp. Sta. Res. Bul. 756, Trends in the Ohio Apple Industry 1889-1953 by M. E. Cravens and R. L. Bere, February, 1955

When compared with apple prices, the farm price of oranges has been declining almost continually since about 1925. Orange prices are now only about one-half as high when compared with apple prices as they were in 1925. At the same time, during the period since 1925 the per capita consumption of oranges has more than doubled relative to that of apples.

If the supply of apples continues to decline relative to that for oranges it is likely that the price of oranges compared with apples will continue to decrease. This does not necessarily mean that the orange industry is hurt thereby and the apple industry benefitted by this price change any more than this has been true during the past 30 years.

FIGURE 5. INDICES OF RATIO OF PROCESSOR PRICES TO FRESH PRICES AND OF RATIO OF PROCESSOR SALES TO FRESH SALES, APPALACHIAN AREA, 1934-1954

Source: W. Va. Agr. Exp. Sta. Bul. 406, Competition and Apple Prices -- (With Emphasis on Processors in the Appalachian Area) by Homer C. Evans, June, 1957.

Since 1934 both the price and quantity of apples for processing has risen relative to that for the fresh market.

From the bulletin listed above we quote:"Fresh price appears to be established on a national basis under conditions approaching those of pure competition. The quantity of apples received by processors in the Appalachian Area is determined largely by the price of apples for processing relative to fresh apple prices. This is outside the control of processors. A rough approximation of this relationship is presented in the figure above. The solid line represents an index of the ratio of processor prices to fresh prices in the Appalachian Area and the broken line represents an index of processor purchases to fresh purchases The two generally move together with sales tending to fluctuate more than price. This indicates that the supply confronting processors in the Appalachian Area is elastic. The more elastic the supply curve the less the opportunity for excess profits. Therefore, the nature of the supply of apples available to processors rather restricts the opportunity for excess profits.

Also, processors buy on the basis of United States Grades and Standards. This facilitates the comparisons of offers by the different processors. In most cases each grower sells to more than one processor. Consequently, the supply available to any particular processor is dependent upon its price relative to other processors. Therefore, the supply available to any one processor is even more elastic than that for all processors in the area."

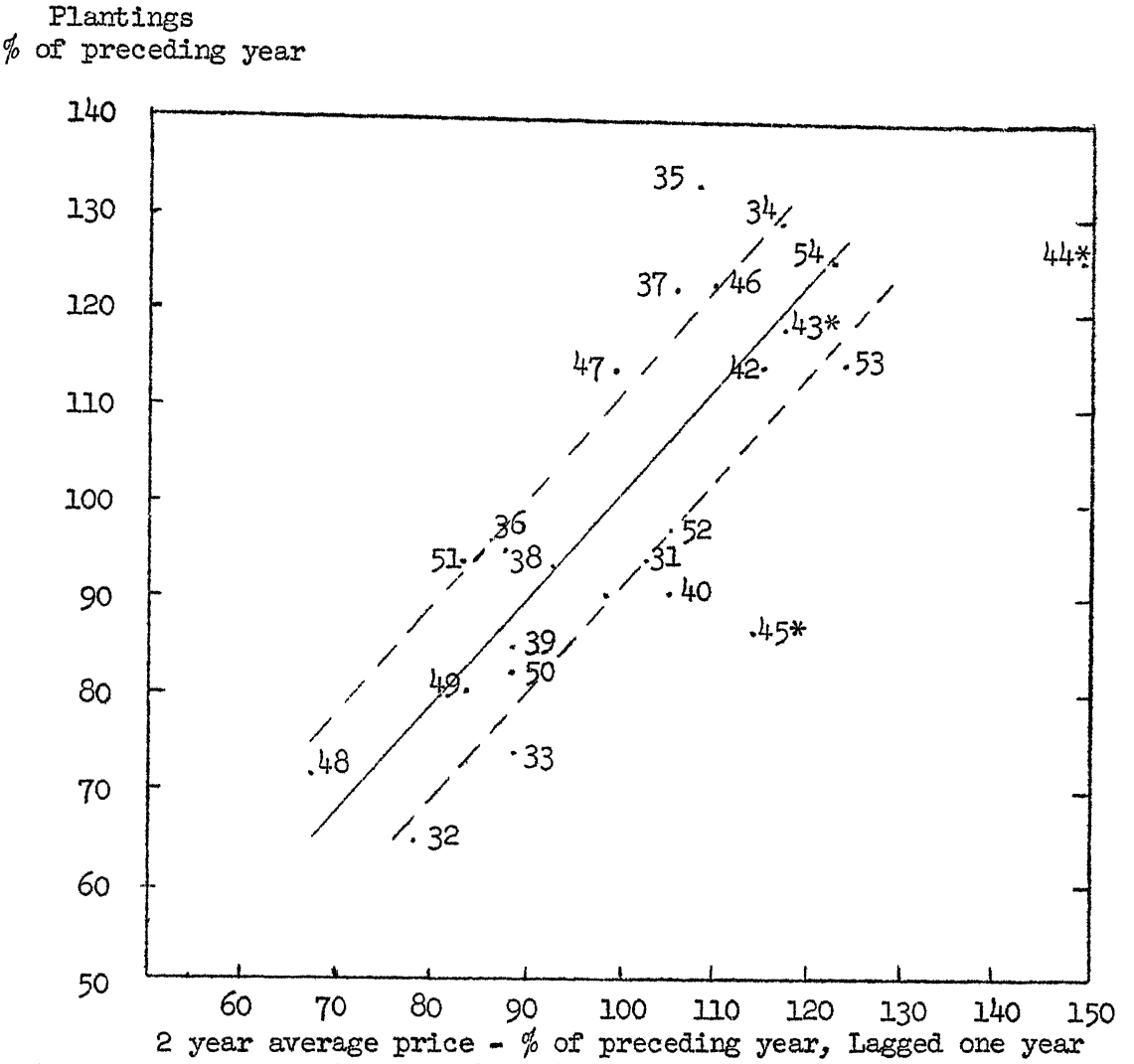
TABLE 2. BEARING AND NON-BEARING TREE NUMBERS, U.S. AND OHIO, 1920-1955

	Total Non-Bearing Trees Reported in Present Census	Trees Planted Between Previous Census & Present Census	Bearing Trees Reported in Present Census	Removals Since Previous Census	% Removals Since Previous Census
Ohio	(000)	(000)	(000)	(000)	%
1920	2,048	1,280	5,970	-	-
1925	2,066	1,554	5,354	2,152	36.0
1930	1,939	1,317	4,661	2,139	40.0
1935	1,432	905	5,263	810	17.4
1940	856	494	3,494	2,839	54.0
1945	450	252	3,250	903	25.8
1950	460	359	2,176	1,424	43.8
1955	295	151	1,235	1,255	57.7
United States					
1920	36,173	22,608	115,281	-	-
1925	34,280	25,236	103,670	38,741	33.6
1930	27,437	17,342	88,815	39,041	37.7
1935	17,510	10,573	82,509	26,806	30.2
1940	13,507	9,278	58,145	37,644	45.6
1945	11,776	8,064	54,000	13,942	24.0
1950	11,089	7,863	39,498	24,052	44.5
1955	6,800	3,655	25,044	22,397	56.7

Source: Ohio Agr. Exp. Sta. Res. Bul. 756, Trends in the Ohio Apple Industry 1889 - 1953 by M. E. Cravens, Jr. and R. L. Bere, February, 1955

A most striking fact is the continued decline in non-bearing tree numbers reported for successive census periods. These have declined from over 36 million trees in the U.S. in 1920 to less than 7 million today. During the same period the removals of trees has been occurring at a rate that is greater than plantings so that total bearing tree numbers have declined even more than have plantings. The apparent removals between the 1950 and 1955 census amounted to more than 50 per cent of the bearing trees in 1950. The effect of the declines on apple production has been relatively small, probably because the removals have been greatest on the poorer sites.

FIGURE 6. RELATIONSHIP BETWEEN APPLE PRICES AND APPLE TREE SALES BY MAJOR U.S. NURSERIES, 1930-1954



2 year average price - % of preceding year, Lagged one year

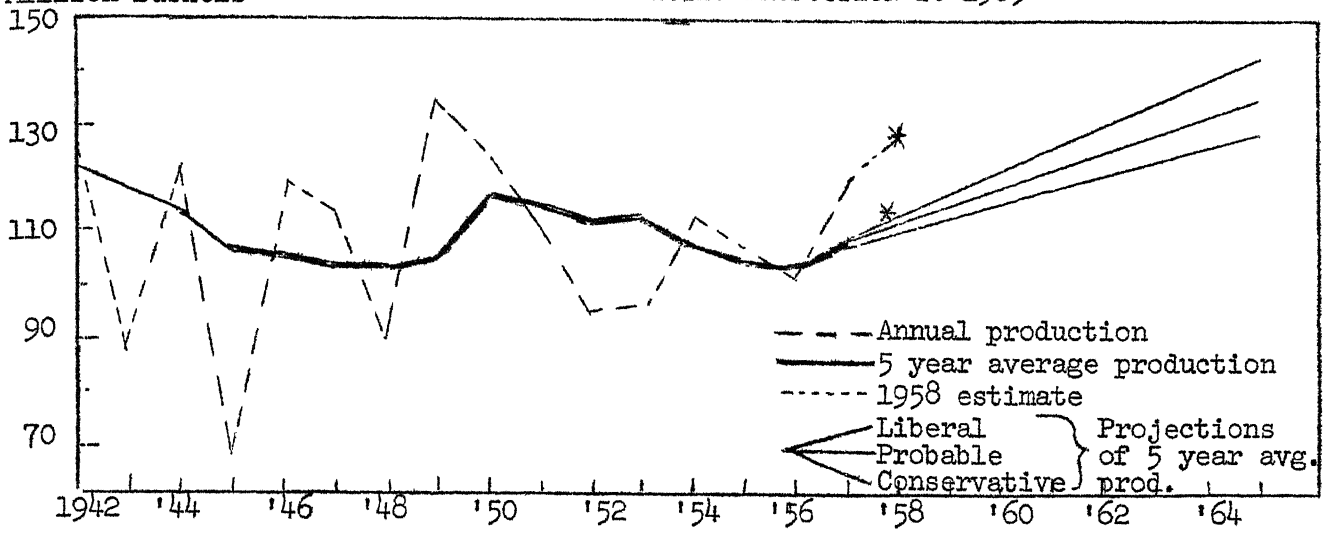
*War years not included in calculations.

Source: Unpublished data obtained from major U. S. Nurseries by M.E. Cravens, Jr., Ohio State University

Nursery sales of apple trees are highly related to apple prices. On the average a 10 per cent increase in the two year average price of apples has meant about a 10 per cent increase in tree plantings a year later or a 10 per cent price decrease has meant a 10 per cent decline in plantings.* It is probable that current tree plantings have been below normal for two or three years and will continue below normal for at least two or three more years. Of course, "normal" plantings for any period may be too high or too low for profitable apple production. Certainly, as better sites are selected and better management practiced, the effect of a given level of plantings on production is different than formerly.

*For instance, a 10 per cent increase in the average apple price of 1950 and 1951 over 1949 and 1950 would mean a 10 per cent increase in nursery stock sales in 1952 on the average.

FIGURE 7. U.S. APPLE PRODUCTION, 1942 TO 1957 AND PREDICTED PRODUCTION TO 1965



Source: National Apple Inst. Bul. 408, Trends in Apple Production by Ray Brush, November 15, 1958.

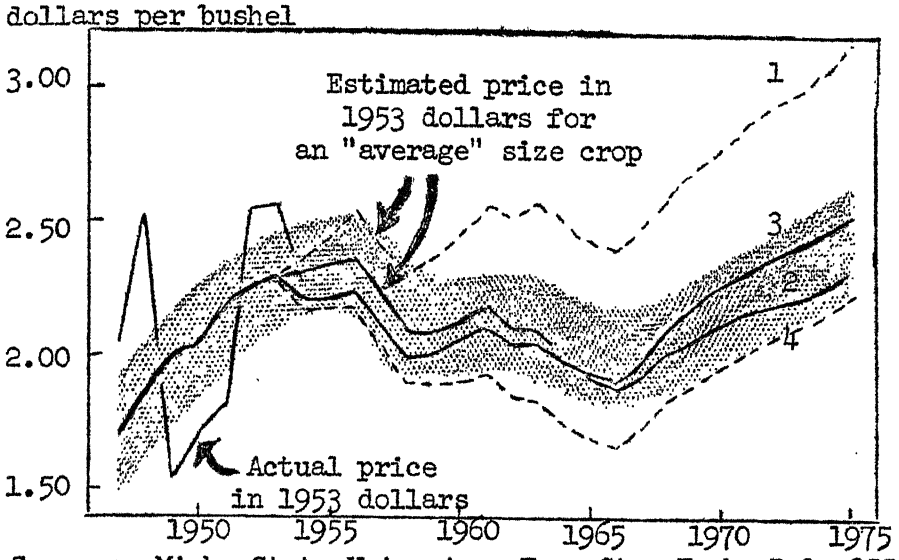
The above analysis by Ray Brush indicates a probable increase in total annual apple production capability by perhaps one-fifth to one-third between 1957 and 1965. This analysis was based on recent tree surveys in 12 apple producing states. This increase in production will mean that the probable 1965 apple production will be above that in the 1940's and 1950's. The same analysis shows a wide variation in these trends among the major varieties. The greatest increase is expected in Delicious, Golden Delicious, Rome Beauty, and Jonathan varieties. Declines in production are expected in the Baldwin and Newtown Pippin varieties. Between these extremes are the McIntosh, Winesap, York Imperial and Stayman varieties.

It would appear that the increases are greater in the dessert varieties than in the strictly processing varieties. This is contrary to the trend in consumption of processed and dessert apples.*

*Production Estimates by Variety for U.S.

Variety	1953-1957 Production	Range in Production by 1965	Change in Production
		(Million bushels)	
Golden Delicious	4.1	8.5	4.4
Delicious	22.6	31-36	8.4-13.4
Rome Beauty	7.0	10.5	3.5
Jonathan	7.7	9.0	1.3
York Imperial	5.2	6.0	.8
McIntosh	13.0	13.0	0
Winesap	11.5	11.5	0
Stayman	5.0	5.0	0
Newtown-Pippin	4.5	4.3	-0.2
Baldwin	3.0	2.0	-1.0

FIGURES 8 AND 9. ESTIMATED "AVERAGE" APPLE PRODUCTION AND FARM PRICE, U.S., PROJECTED TO 1975

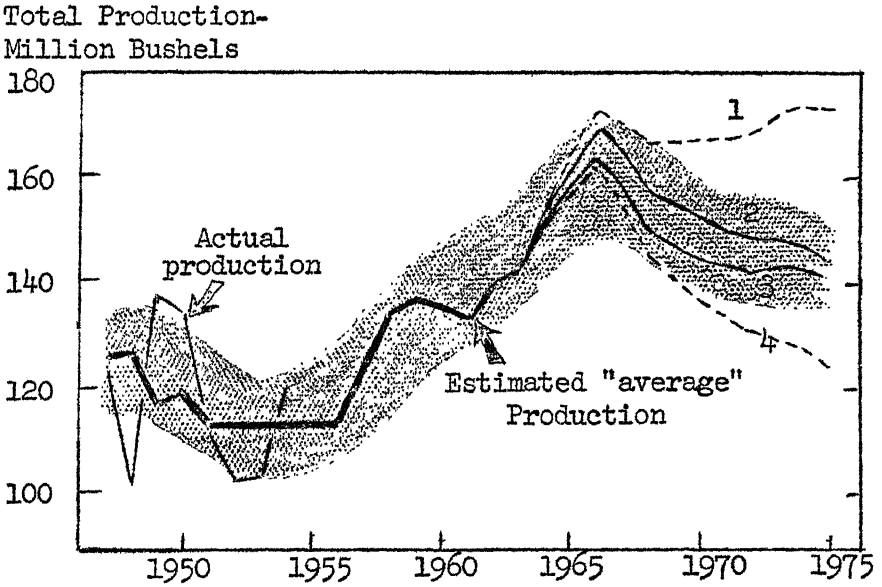


Source: Mich. State Univ. Agr. Exp. Sta. Tech. Bul. 255 The Long Term Price & Production Outlook for the U.S. & Michigan by B.C. French, April, 1955

The charts on this page are the result of complex mathematical calculations based on "average" crops. The methods used are explained in the bulletin cited. In the prediction of price, French used several assumed rates of population growth, of increases in personal disposable income and of consumption of competing fruits. The line labeled 3 on the chart projects what he believes to be the "most probable" trend to 1975. Line 2 projects a trend based on current demand to 1975 except for population increases. Lines 1 and 4 are based respectively on optimistic and pessimistic assumptions of what might happen. The shaded area indicates the area of highest expectation of predictions.

In the prediction of production the effects of apple prices on apple tree numbers and production were assumed to be similar to those during the past. In other words, an increase in apple prices will continue to bring a similar proportionate increase in plantings while an unfavorable price will cause a similar decrease in plantings.

On the basis of these assumptions as to production and price, French concludes that prices will decline generally until 1966 then turn up again at least to 1975, while production will generally increase until 1966, then begin to decline once more.



Source: Same as above.

SUMMARY

Since most of the findings are presented in summary form there is little need for a further summary. However, some conclusions stand out and seem worthy of emphasis.

1. Barring unusual winter injury or other catastrophe the size of the "average" apple crop will increase for the next 6 or 7 years. The increase may be as much as 20 to 33 per cent of the present size crop and apparently will be greater in the "dessert" than in the processing varieties.
2. Apple Prices, after adjusting for the value of the dollar, are largely determined by apple supply and consumer real income. About 95 per cent of the year to year variation of apple prices from 1922-41 could be explained by these two factors. The supply of competing fruit probably has an effect but this was not a major factor in any of the analyses except that by French who explained 95 per cent of the price variation for the period 1930-1953.
3. Apple production, for any period, is determined primarily by plantings made ten or more years previously. Plantings for any year are determined largely by the profitableness of apples during the previous few years. It is likely that plantings have been relatively low during the past few years.
4. Apple consumption in the processed forms is continually increasing.
5. Improved statistics of tree numbers and ages and yearly plantings by varieties would be desirable.
6. A final conclusion from these studies might be --- since such a large percentage of the price received can be explained on the basis of apple supply, consumer income and supply of competing fruit, any program for materially improving the farm price of apples must somehow control one or more of these factors if it is to succeed.